COMPARISON OF THE INTRUSION EFFECTS ON THE MAXILLARY INCISORS AMONG IMPLANT ANCHORAGE, 'J' HOOKS HEADGEAR AND UTILITY ARCH

Dissertation Submitted To

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

In Partial Fulfilment for the Degree of

MASTER OF DENTAL SURGERY

BRANCH V

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

APRIL 2011

CERTIFICATE

This is to certify that the dissertation entitled **"Comparison of the intrusion effects on the maxillary incisors among implant anchorage, 'J' hook headgear and utility arch".** done by **Dr. RAVINDRA KUMAR JAIN,** Post graduate student (M.D.S), Orthodontics **(branch V)**, Tamil Nadu Govt. Dental College and Hospital, Chennai, submitted to the Tamil Nadu Dr.M.G.R.Medical University in partial fulfilment for the M.D.S. degree examination **(April 2011)** is a bonafide research work carried out by him under our supervision and guidance.

Guided By

Dr. W. S. MANJULA M.D.S
Professor and Head of Department,
Dept. of Orthodontics,
Tamil Nadu Govt Dental College & Hospital, Chennai-3

Dr. S. PREM KUMAR M.D.S
Reader
Dept. of Orthodontics,
Tamil Nadu Govt Dental College & Hospital, Chennai-3

Dr. W.S.MANJULA M.D.S.,
Professor and Head of Department
Dept. of Orthodontics,
Tamil Nadu Govt Dental College & Hospital, Chennai-3

Dr.K.S.G.A. NASSER, M.D.S.,
Principal,
Tamil Nadu Govt Dental College & Hospital, Chennai-3

DECLARATION

I, **Dr. Ravindra Kumar jain,** do hereby declare that the dissertation titled **"Comparison of the intrusion effects on the maxillary incisors among implant anchorage, 'J' hook headgear and utility arch."** was done in the Department of Orthodontics, Tamil Nadu Government Dental College & Hospital, Chennai 600 003. I have utilized the facilities provided in the Government Dental College for the study in partial fulfilment of the requirements for the degree of Master of Dental Surgery in the specialty of Orthodontics and Dentofacial Orthopaedics **(Branch V)** during the course period **2008-2011** under the conceptualization and guidance of my dissertation guides, **Professor and HOD Dr.W.S.MANJULA M.D.S. and Reader Dr. S.PREM KUMAR M.D.S**

I declare that no part of the dissertation will be utilized for gaining financial assistance for research or other promotions without obtaining prior permission from the Tamil Nadu Government Dental College & Hospital.

I also declare that no part of this work will be published either in the print or electronic media except with those who have been actively involved in this dissertation work and I firmly affirm that the right to preserve or publish this work rests solely with the prior permission of the Principal, Tamil Nadu Government Dental College & Hospital, Chennai 600 003, but with the vested right that I shall be cited as the author(s).

Signature of the PG student *Signature of the HOD*

Signature of the Head of the Institution

ACKNOWLEDGMENT

My sincere thanks to **Dr.K.S.G.A.NASSER, M.D.S., Principal**, Tamil Nadu Government Dental College and Hospital, Chennai-3, for his kind support and encouragement.

I express my deep sense of gratitude and great honour to my guide **Dr.W.S.MANJULA M.D.S., Professor & Head of the Department**, Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for her inspiration and encouragement throughout the study and the entire course.

I owe my thanks and great honour to **Dr.C.KARUNANITHI M.D.S., Professor** Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for his patience guidance, support and encouragement throughout the study.

I owe my thanks and great honour to **Dr.M.C.SAINATH M.D.S, Professor**, Department of Orthodontics and Dentofacial Orthopaedics, Tamilnadu Govt. Dental College and Hospital, Chennai-3, for helping me with his valuable and timely suggestions and encouragement.

I owe my thanks and great honour to my guide, **Dr. S. PREM KUMAR., M.D.S., Reader**, Department of Orthodontics, Tamilnadu Government Dental College and Hospital, Chennai-3 for his support and encouragement.

I am grateful to **Dr. B.BALASHANMUGAM, M.D.S., Assistant Professor**, Department of Orthodontics, Tamil Nadu Government Dental College and Hospital, Chennai –3 for his support and encouragement.

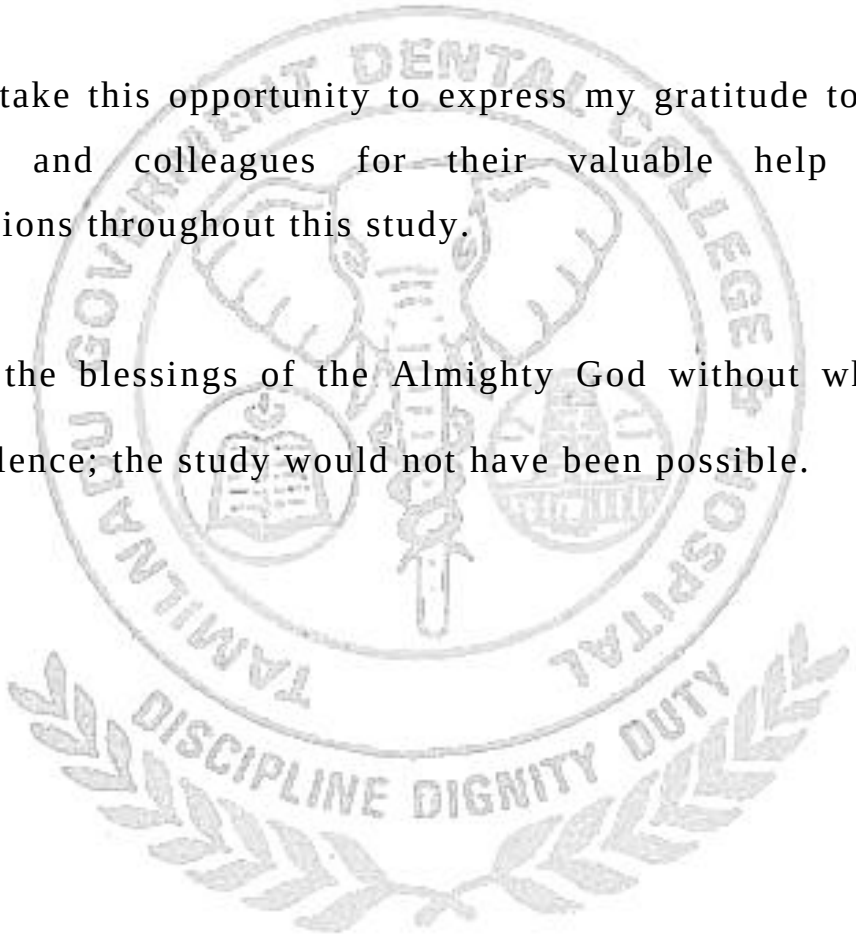
I am grateful to **Dr. USHA RAO, M.D.S., Assistant Professor**, of Department of Orthodontics, Tamil Nadu Government Dental College and Hospital, Chennai –3 for her support and encouragement.

I convey my sincere thanks to **Dr. G. RAVANAN, M.Sc., M.Phil., Ph.D., Professor of Statistics**, Presidency College, for helping me with the Statistics in the study.

I offer my heartiest gratitude to my family members for their selfless blessings.

I take this opportunity to express my gratitude to my friends and colleagues for their valuable help and suggestions throughout this study.

I seek the blessings of the Almighty God without whose benevolence; the study would not have been possible.



CONTENTS

Sl. No.	TITLE	Page No
1.	Introduction	**1**
2.	Aims and Objectives	**4**
3.	Review of Literature	**5**
4.	Materials and Methods	**27**
5.	Results	**40**
6.	Discussion	**55**
7.	Summary and Conclusion	**62**
8.	Bibliography	
9.	Annexure	

LIST OF TABLES

S.NO		PAGE NO.
1.	TREATMENT RESULTS - GROUP 1	**41**
2.	TREATMENT RESULTS - GROUP2	**42**
3.	TREATMENT RESULTS - GROUP3	**43**
4.	STUDENT'S 'T' TEST RESULTS - GROUP 1	**45**
5.	STUDENT'S 'T' TEST RESULTS - GROUP 2	**46**
6.	STUDENT'S 'T' TEST RESULTS - GROUP 3	**47**
7.	ANOVA – RESULTS	**49**
8.	DIFFERENCE ANOVA – RESULTS	**51**
9.	TUKEY HSD – RESULTS	**54**

LIST OF COLOUR PLATES

S.NO		PAGE NO
1.	a. Armamentarium – group 1 b. Mini Implant Intra Oral View	**34**
2.	a. Niti coil springs b. Dontrix guage	**35**
3.	a. J- Hooks Intra Oral View b. J- Hooks Extra Oral View	**36**
4.	Utility arch- a) intraoral frontal view b) intraoral lateral view	**37**
5.	Cephalostat	**38**
6.	Cephalometric Tracing	**39**

LIST OF ANNEXURES

S.NO		PAGE NO.
1.	INFORMED CONSENT FORM (English)	
2.	INFORMED CONSENT FORM (Tamil)	
3.	INFORMATION SHEET (English)	
4.	INFORMATION SHEET (Tamil)	
5.	CHECKLIST	
6.	ETHICAL COMMITEE CERTIFICATE	

INTRODUCTION

Correction of deep bite during orthodontic therapy is a difficult biomechanical challenge. Deep bite is a clinical problem not to be seen in terms of millimetres but to be seen in light of future changes in the aesthetics, function and health of the dentition (Moyers[50]). Possible complications of deep bite include, temporomandibular joint disorders, unacceptable facial aesthetics, Attrition of incisors, spacing of maxillary incisors, clenching of teeth, jaw stiffness, head ache and ringing in ears (Sonneson[54]).

Deep bite may be accompanied by spacing with flared incisors or intra arch crowding which necessitates extraction of premolars. In either extraction or non extraction cases deep bite must be corrected to ensure complete space closure. Methods to correct deep bite include extrusion of posterior teeth, relative intrusion of incisors and true intrusion of incisors (Nanda[40] and Proffit[46]).

Extrusion of posterior teeth is one of the most common methods to correct deep bite. It is indicated in patients with short lower facial height, excessive curve of Spee, mild to moderate incisor display and in growing patients[40]. Deep bite correction by extrusion of posterior teeth is unstable and is not indicated in adult patients and vertical growers. Relative intrusion is prevention of incisor eruption in growing patients and is achieved with functional appliances (Proffit[46]).

Intrusion is defined as the axial movement of the tooth along the long axis towards the apex of the root. Intrusion of incisors is primarily indicated in deep bite cases with a large vertical dimension, patients with excessive incision stomion distance and a large inter labial gap. Intrusion of incisors is one of the most difficult tooth movements to achieve. It requires very light and continuous force, and there is always a risk of apical root resorption[46]. Advantages of deep bite correction by intrusion of anterior teeth include achievement of lip competency, reduced incisal exposure, without any increase in lower anterior facial height[40].

Appliances for incisor intrusion include utility arch by Ricketts, Burstone intrusion arch, Connecticut intrusion arch, and J-hook headgear. The major disadvantages with these appliances include extrusion and tipping of posterior teeth, complex wire bending and patient co-operation.

Miniscrews have been successfully used as temporary anchorage devices for producing various tooth movements, like en mass retraction of anteriors[28], intrusion of anteriors[28] and molars, molar uprighting and so on. Since anchorage control and patient cooperation is very critical in any orthodontic set up, miniscrews as effective temporary anchorage devices have occupied a central role and they are devoid of patient compliance.

AIMS AND OBJECTIVES

The aims of this study are i) to evaluate the efficiency of producing intrusion of maxillary incisors using mini implants, utility arch and J-hook headgear and ii) to compare the amount of intrusion produced among the three appliances.

REVIEW OF LITERATURE

Deep bite – complications and management

J.V Mershon (1937)[36] published "Treatise on possibilities and limitations in the treatment of closed bites" and concluded that, "of all the conditions which the dentist encounters, probably the least understood and most difficult to treat is the closed bite".

Magill (1960)[33] stated that intrusion of incisors was necessary for overbite correction and to compensate for the increased overbite tendency that is apparent when incisors are retracted.

Dellinger (1967)[17] first demonstrated intrusion histologically and cephalometrically, he noticed that during application of intrusive force the PDL was in a state of tension and thickened, while new trabeculae of bone were formed.

Ricketts (1969)[49] said "deep bite should be corrected by intruding the offending incisors to the functional occlusal plane".

Stenvik and **Mjor (1970)**[56] investigated the effect of intrusion on pulps and dentin of human premolars, where in they observed vacuolization in the odontoblastic layer and a reduction in the width of the predentin zone, and found that force levels above 150-250gms caused stasis of the pulpal vessels.

Reitan (1974)[48] studied intrusion of human premolars and concluded that forces not exceeding 30gms did not result in any root damage.

Burstone (1977)[9] stated, "every patient with deep over bite requires a comprehensive treatment plan which establishes how the deep bite should be corrected either by extrusion of posterior teeth, or inhibition and genuine intrusion of anterior teeth. This decision is based in part on where the clinician desires to place the occlusal plane, the

amount of mandibular growth anticipated and the vertical dimension desired at the end of treatment".

Burstone (1977)[9] defined intrusion as "the apical movement of the geometric centre of the root (centroid) in respect to the occlusal plane or a plane based on the long axis of the tooth".

Janzen (1977)[27] stated that "intrusion offers the possibility of adjusting the level of the incisors in relation to both the proposed occlusal plane and the upper lip".

Bhavna (1995)[6] said "deep overbite correction by intrusion of anterior teeth affords a number of advantages including simplifying control of vertical dimension and allowing forward rotation of the mandible to aid in class II correction. Intrusion of incisors to correct deep overbite may be indicated in patients with excessive maxillary incisors show at rest and a deep mandibular curve of Spee associated with a long lower facial height".

Nanda (1997)[40] stated that the amount of root resorption was not correlated with the amount of intrusion. Results of his study seem to indicate that intrusion with low forces can be effective in reducing overbite while causing only a negligible amount of apical root resorption.

Nanda (1997)[40] stated that deep overbite is one of the most common features of adult malocclusions. Treatment of deep overbites involves a careful diagnosis, treatment plan, and mechanics plan. Pure intrusion of upper or lower incisors alone or in combination with flaring and extrusion of posterior teeth are common methods to correct deep overbites.

Van Steenbergen (2005)[59] investigated and correlated various factors and found them statistically insignificant. The various factors are1) the distance from the point of force application to the centre of resistance at the start of intrusion and the change in axial inclination of the incisor, (2) distance from the point of force application to the centre of resistance at the start of intrusion and the change in distance from the incisal edge to the distal side of the first

molar, (3) distance from the point of intrusive force application to the centre of resistance at the start of intrusion and at the end of intrusion, (4) distance from the point of intrusive force application to the centre of resistance at the start of intrusion and the change in this distance between start and end of intrusion, and (5)amount of intrusion and the change in axial inclination.

Sonnesen (2008)[54] examined temporomandibular disorders (TMDs) and psychological status in adult patients with a deep bite and compared with an adult age- and gender-matched control group with neutral occlusion. The deep bite group consisted of 20 females (mean age 30.3 years) and 10 males (mean age 33.1 years). Deep bite patients more frequently reported nocturnal and diurnal clenching, an uncomfortable bite, jaw stiffness, and 'ringing' in the ears than the controls. Headache, muscle disorders, disc displacement, and other joint disorders occurred significantly more often in the deep bite group compared with the controls. Headache, muscle disorders, disc displacement, and other joint disorders were significantly associated with a number of craniofacial

dimensions and psychological. These findings suggest that a deep bite, in particular with retroclined upper incisors, can represent a risk factor for TMD.

Appliances for deep bite correction

Robert Ricketts (1950)[49] gave the utility arch or the step down base arch for correction of the curve of Spee by intrusion of lower incisors. He refined the utility arch for incorporation into bio progressive therapy in 1979.

Burstone (1966)[8] gave the biomechanical principles of utility arch

Farrant (1980)[20] described the use of a high pull headgear with J hooks for maxillary canine retraction combined with straight pull for mandibular canine retraction.

Otto et al (1980)[41] described the treatment effects of a lower utility arch wire according to bio progressive therapy technique in 24 adults and 31 children having deep overbite. An average of 2.5mm of actual lower incisor

intrusion was found in the adult group and 2mm in the children's group

Dake ML, **Sinclair PM (1989)**[15] compared 30 non extraction deep bite low angle cases treated by Ricketts utility arch to a similar group treated by Tweeds technique. The Ricketts group showed more proclination of lower incisors than Tweeds, more post treatment up righting, also 1.2mm of actual intrusion of lower incisors in addition to holding against growth.

Davidowitch (1995)[16] stated that the utility arch is a two-couple intrusion arch wire used for control of anterior deep overbite. It is similar to a one-couple intrusion arch in that it is commonly made with rectangular wire, attached to the teeth only at the molars and the incisors and is activated for incisor intrusion by a molar tip back bend. It differs from a one-couple intrusion arch by the insertion of the incisor segment into the incisor brackets. This results in a fixed point of application of the intrusion force anterior to the incisors and, therefore, incisor rotation by the moment of the force. In addition, insertion of the rectangular wire into

the incisor brackets usually creates a third-order couple for incisor rotation.

Willes G (2001)[60] in finite element study stated that greatest amount of relative stress at the apex of maxillary central incisor occurred with intrusion, extrusion and rotation.

Sifakakis (2009)[53] concluded that the upper Burstone 0.017 x 0.025' TMA intrusion arch exerted the lowest forces/moments on posterior teeth. The highest forces were generated by the 0.016 x 0.016-inch Blue Elgiloy utility arch and the highest moments by the lower 0.017 x 0.025-inch TMA utility arch.

MINI IMPLANTS

Gainforth and **Higley (1946)**[21] were the first to describe temporary anchorage devices; they used a 3.4mm diameter and 13mm long Vitallium screw in a 2.4mm pilot hole in the ascending ramus of mandible of 6 dogs and a rubber band was used to deliver force for retracting the canine.

Creekmore and **Eklund (1983)**[14] published the first clinical report of the use of temporary anchorage devices in literature. They used a Vitallium bone screw to treat a patient with a deep impinging overbite. The screw was inserted in the anterior nasal spine to intrude the upper incisors using elastic from the screw to the incisors ten days after the screw was placed.

Gray J.B (1983)[23] stated that orthodontic force application can begin almost immediately after implant placement.

Southard (1995)[55] concluded that rigid endosseous implants are superior to dental anchorage for orthodontic

intrusion of teeth and offer a practical means to intrude anterior teeth.

Kanomi (1997)[28] reported the use of mini implants for intruding mandibular incisors and successfully intruded them by 6mm.

Costa and **colleagues (1998)**[12] reported the use of miniscrews for anchorage, they did immediate loading and noted that only 2 of the 16 miniscrews loosened and were lost before completion of orthodontic treatment.

Melsen and **Costa (2000)**[35] said primary stability is an important factor for mini screw success. Primary stability expresses the initial stability of a recently placed implant. It is a function of the mechanical retention of the implant in the bone and is therefore greatly influenced by the design of the implant shank and the density and amount of implant bed bone. Primary stability is important when the implant is immediately loaded.

Bae (2001)[42] reported a case of class I bimaxillary protrusion treated with mini implant anchorage for retracting the maxillary anteriors and up righting the mandibular molars.

Park (2001)[41] concluded that the overall success rate of orthodontic mini-implants were 91.6%, with a mean period of force application of 15 months. Therefore, screw implants can be used for orthodontic anchorage predictably and consistently in routine orthodontic practice. Mobility, the patient's right side, mandibular implant sites, and inflammation were associated with screw implant failure in this study. To minimize failure, clinicians should attempt to reduce inflammation around the screw implants, especially for screws placed on the right side in the mandible

Miyawaki (2003)[38] concluded that, if an implant anchor is to be placed into the buccal alveolar bone of the posterior region then use of titanium screws with a diameter of more than 1.0mm (e.g., 1.5 mm) is desirable in patients with an average-to-low mandibular plane angle, and the smaller the better so that there is less surgical invasion and

less anatomic limitation. The use of titanium screws with a diameter of more than 2.3 mm, or of mini plates if the use of a screw is difficult, is desirable in patients with a high mandibular plane angle (i.e., with thin cortical bone). Prevention of inflammation of peri-implant tissue is Important to prevent mobility of the implant anchor. Flapless surgery is desirable to minimize patient discomfort. Immediate loading is possible if the applied force is less than 2 N.

Kuroda (2004)[32] reported closing anterior open bite by intrusion of molars with mini screw anchorage.

Marissa (2004)[34] found that the clinician should be aware that it may not be possible to place miniscrews in attached gingiva because of a lack of inter radicular bone at these sites. This may necessitate design modification in the screw head or placement techniques to decrease soft tissue irritation.

Van steenbergen (2005)[58] stated that, maxillary incisors could be intruded with forces of 10 to 20 g per

tooth. There was no statistically significant difference in extrusion of the buccal segments between the 40- and 80-g groups.

Cope J.B (2005)[11] gave the classification of temporary anchorage devices.

Ohnishi (2005)[24] reported intrusion of upper incisor segment with mini implant placed between two central incisors.

Park (2006)[26] concluded that to minimize the failure of screw implants, inflammation around the implants must be controlled especially for screws placed in the right side of the mandible.

Kim (2006)[30] treated a case with severely extruded and retroclined maxillary incisors which were intruded and proclined with a nickel-titanium closed-coil spring anchored to a mini-implant placed between the maxillary central incisors with segmented wires; thus resolving the

gummy smile and deep overbite efficiently without extruding the maxillary molars or opening the mandible.

.

Park (2006)[26] evaluated the angle between the miniscrews long axis and the cortical bone, he found that, placing screws not perpendicular to the bone surface but at an obtuse angle, lowered the risk of root damage and increased the screws contact with the cortical bone.

Poggio (2006)[44] and colleagues recommended a minimum clearance of 1mm between a miniscrews and a root for both periodontal health and mini screw stability. Therefore, it can be concluded that miniscrews with a diameter of 1.5mm or less are safe for interradicular insertion if the space between the roots is at least 3.5mm.

Wilmes B (2006)[61] said mini implant insertion torque, the amount of torque during the placement of an implant reflects the resistance the mini implant encounters when advancing into the bone. This resistance is proportional to the amount of bone compression during placement and therefore increases with greater cortical bone thickness. It

can also serve as an indirect measure for the primary stability of the mini implant. A high insertion torque results in high primary stability, in this respect increased insertion torque can be interpreted as favourable. They also described the secondary stability as the stability after the placement site has healed and is a consequence of bone formation and remodelling at the implant bone interface and the surrounding bone. It is responsible for implant success after the healing period and is the determining factor for success during most of the loading period.

Kuroda and **Sugawara (2007)**[31] reported that miniscrews placed without surgery have high success rates than the miniscrews placed with flap surgery.

Giulliano (2007)[37] showed that contact between a dental root and a drill, screw, or both caused resorptive root damage. After discontinuation of the contact, however, repair begins to occur through the deposition of cellular cementum

Sadowsky (2007)[2] found that overbite correction by intrusion of incisors with miniscrew anchorage is very stable**.**

Benedict Wilmes (2008)[5] concluded that to achieve the best primary stability for mini screws, an insertion angle ranging from 60 to 70 degree is advisable. If the available space between two adjacent roots is small, a more oblique direction of insertion seems to be favourable to minimize the risk of root contact.

Upadhyay (2008)[57] used mini-implants between the roots of the maxillary lateral incisor and canine to intrude all the maxillary anterior teeth en masse in a single step. Four millimetres of intrusion was achieved. The implants remained stable throughout treatment. Good over jet and overbite was achieved and has been maintained one year after completion of active orthodontic treatment.

Polat-Oszoy (2009)[45] used miniscrews between maxillary lateral incisor and canine bilaterally for intruding the maxillary incisors. They applied force using NITI

closed coil springs and recorded mean upper incisor intrusion of 1.92 mm. According to them true intrusion can be achieved by application of intrusive forces close to the centre of resistance using miniscrews.

Rahul Renjen (2009)[47] studied the root and pulp response after intentional injury from miniscrew placement and gave the following conclusions

a. There was no evidence of inflammatory infiltrate or necrosis in the pulpal tissue or along the injured root surfaces
b. Reparative cementum was along the periphery of each injured tooth and along displaced dentin fragments in apposition of the periodontal ligament.
c. The presence of woven bone intimately related with miniscrew threads lends evidence to support the osseointegration of miniscrews.
d. Injuries to roots ranged from cementum abrasion to severe root impalement with complete separation of root fragments.

e. In case of root injury with displacement of fragments, points of ankylosis were present with the surrounding bone.
f. Mini screws placed manually can penetrate dentin.

Amr Ragab El-Beialy (2009)[3] did a three dimensional assessment on loss of anchorage of miniscrews and concluded that, movement of miniscrews is to be expected during orthodontic loading. This phenomenon should be considered when determining their dimensions and placement angles to provide the maximum range of action for orthodontic mechanics without mid treatment replacement of mini screws.

Kim S.H **(2010)**[29] Root proximity alone was not considered a major risk factor for osseointegration-based mini-implant failure.

Adriano Crismani (2010)[1] in his review and analysis of published clinical trials concluded that success rates for miniscrews were sufficient for orthodontic treatment. His review further showed that screws of 1.2mm diameter and

at least 8mm length are preferable, because they are stable and minimize the risk of root damage. The maxilla was shown to be better suited for miniscrews. As for the placement protocol, the data were inconclusive for definite recommendations. At comparable success rates, the flapless method should be chosen because it is less invasive and causes less patient discomfort. Immediate or early loading is possible, since longer healing periods didn't provide additional stability at forces of up to 200cN.

Michael B. Packard (2010)[37] in his study on "effects of miniscrew orientation on implant stability and resistance to failure" gave the following conclusions 1. Miniscrews loaded along their long axis have greater stability and resistance to failure. The more closely the long axis of the screw approximates the line of applied force, the greater the stability and greater its resistance to failure. 2. Miniscrews originally loaded in shear that have lost their primary stability and become displaced can still support an applied load, especially if the apex of the screw is initially in contact with the deep surface of the lingual cortex. 3. Miniscrew stability and resistance to failure is independent

of its orientation along the directions of maximum and minimum bone stiffness. However, patterns of anisotropy in cortical bone do affect the structure of the bone – miniscrew failure site.

Shin- Jae Lee (2010)[52] did a survival analysis of orthodontic mini- implants; he concluded that the hazard function for implant failure showed highest risk immediately after placement. The mean survival time of orthodontic mini- implants is sufficient for relatively long orthodontic treatments. The decreasing pattern of hazard function suggested gradual osseo integration of orthodontic mini – implants. When implants are placed in a young patient, special caution is needed to lessen the increased probability of failure, especially immediately after placement.

Naam-Ki Lee (2010)[39] studied the effects of the diameter and shape of orthodontic mini implants on micro damage to the cortical bone and concluded that increased diameter and tapering resulted in increased values of maximum insertion torque, number of cracks and longest

crack. Similarly with increased diameters there were increases of accumulated crack length, and maximum radius of the crack.

Cheol- Hyun Moon (2010)[10] studied the relationship between vertical skeletal pattern and success rate of orthodontic mini-implants and found that vertical skeletal pattern might be an important factor for the success of orthodontic mini implants placed in posterior buccal areas.

Madhur Upadhyay (2010)[57] studied about vertical dimension control during en masse retraction with mini-implant anchorage concluded that mini-implant assisted anchorage for en masse retraction of anterior teeth in high angle patients delivers a force system that provides effective control over the posterior dento alveolar dimension for significant improvement in chin projection and overall facial profile.

Sebastian Baumgaertel (2010)[51] presented a review of literature to answer the question whether pre drilling of the implant site is useful or not, and he concluded that , many factors can influence mini-implant success rates and

failure can be a multifactorial phenomenon. An ideal torque range for miniscrew insertion is recommended and that insertion torque correlates strongly with cortical bone thickness. It has been reported that pre drilling can reduce insertion torque and therefore aid in controlling torque levels when cortical bone is excessively thick. Therefore implant site preparation with pre drilling can be useful, depending on the present or expected cortical bone thickness at a specific placement site.

Glaucio Serra (2010)[22] studied sequential bone healing of immediately loaded mini- implants and concluded that the 1N immediate force application didn't compromise bone formation around mini implants.

Eric J. W. Liou (2010)[19] studied apical root resorption in orthodontic patients with en masse maxillary anterior retraction and intrusion with miniscrews and concluded that the time needed for the greater amount of maxillary en-masse anterior retraction with miniscrew is longer and might dispose the patient to apical root resorption.

MATERIALS AND METHODS

Case selection criteria

The study was conducted on 30 patients of both genders, who reported to the Department of Orthodontics The Tamilnadu Government Dental College and Hospital for correction of malocclusion.

Inclusion_criteria

1. Subjects with deep bite associated with excessive incisal display both at rest and at smile.
2. Subjects with increased over jet.
3. Subjects with adequate periodontal support.

Exclusion_criteria

1. Subjects with systemic diseases.
2. Low angle cases.

The average age range was 16-22 yrs.

The study was proposed at the Institutional Ethical Committee, of The Tamilnadu Govt Dental College and

Hospital, Chennai, with all the details regarding the study, and the approval was obtained.

Informed written consent was obtained from all the subjects who were willing to participate in this study.

The subjects were divided into 3 groups.

1. Group 1- consisted of 10 subjects, for whom intrusion of maxillary incisors was attempted with mini implant anchorage.
2. Group 2- consisted of 10 subjects, for whom intrusion of maxillary incisors was attempted with J-hook headgear.
3. Group 3- consisted of 10 subjects, for whom intrusion of maxillary incisors was attempted with utility arch.

Group1

In this group, two mini implants 6mm length, 1.4mm diameter (colour plate 1), by DENTOS, Korea were used. They were placed bilaterally between the maxillary central and lateral incisor under local anaesthesia with a long hand driver (colour plate 1).The mini implant position was checked with an IOPA after placement to rule out any root

contact. The subjects were treated with preadjusted edge wise mechanotherapy with first premolar extraction. The base arch wire 19×25 stainless steel was sectioned distal to the lateral incisor (colour plate1).

Orthodontic load was applied by NITI closed coil springs of various sizes (Colour plate 2). The size of the spring used was based on the amount of force needed. One end of the spring was engaged on the implant and the other end to a hook welded on to the base arch wire (colour plate1).

Force was checked using a Dontrix guage and adjusted Force was checked using a Dontrix guage and adjusted to 1.5 ounces on each side (colour plate2). Subjects were reviewed once monthly. During the monthly appointments intrusion force was rechecked and adjusted.

Group 2

All subjects were treated with preadjusted edgewise mechanotherapy and maxillary first premolar extraction. The base arch wire was 19×25 S.S. J-Hooks were made of

cycle spokes wire (colour plate 3). They were adapted on to the arch wire between the maxillary central and lateral incisors.

Force was delivered by an elastic strap connected to an occipital pull headgear (colour plate 3). The amount of force delivered was 2 ounces each side using a Dontrix gauge. Monthly appointments were given to recheck and adjust the amount of force applied, patient compliance and any appliance breakage. All subjects were requested to wear the headgear at night.

Group 3

All subjects were treated with preadjusted edge wise appliance and maxillary first premolar extraction.

Ricketts utility arch made of 19×25 Blue elgiloy (colour plate 4) was used for intrusion of the maxillary incisors. The utility was sleeved to prevent any tissue irritation. It was also cinched back to prevent incisor proclination.

The amount of force delivered was 1.5 ounces on each side. A Dontrix gauge was used to check the force applied and monthly appointments were given to recheck and adjust the amount of force applied.

DIAGNOSTIC RECORDS

RADIOGRAPHS

Lateral cephalogram, maxillary anterior occlusal radiograph, and intra oral periapical radiograph were taken before beginning intrusion of maxillary incisors in all the three groups. Immediately after intrusion study period lateral cephalograms were taken to measure the amount of intrusion. All radiographs were taken by a single operator at the department of radiology, The Tamilnadu Government Dental College and Hospital. All the subjects were positioned properly on a universal counter-balancing type of cephalostat (colour plate 5) with the Frankfort horizontal plane parallel to the floor and the teeth in centric occlusion and lips relaxed. This position was standardized for all patients.

Kodak X-ray films (8”x10”) were exposed at 70 Kvp, 30mA for 1.8 seconds from a fixed distance of 60 inches. All cephalograms were taken from the same cephalostat.

All lateral cephalometric radiographs were manually traced on an acetate paper of 0.5µ thickness with sharp 3H pencil on a view box by same operator and rechecked randomly (colour plate6).

Photographs

Extra oral and intraoral photographs were taken before beginning the study and after completion. All the photographs were taken by a Nikon digital camera.

Models

Models were made before beginning the study and also after completion. Irreversible Hydrocolloid was used to make the impressions and Orthocal was used to pour the impressions.

Study duration

Study duration was 120 days in all the three groups.

CEPHALOMETRIC ANALYSIS

Cephalometric analysis was done to satisfy the selection criteria and to measure the amount of intrusion effects produced in all the three groups.

Parameters used to measure intrusion

OVERJET	Horizontal distance from the incisal edge of the upper incisor to the labial surface of the lower incisor.
OVERBITE	Vertical distance between the incisal edges of the upper and lower incisors.
PP-U1	Vertical distance from maxillary incisal edge to palatal plane.
PP-U6	Vertical distance from maxillary molar cusp to palatal plane.
UL-U1	Vertical distance from maxillary incisal edge to upper lip.

Cephalometric analysis was done on both pre treatment and post treatment radiographs. The findings were then recorded and compared.

Fig: 1a ARMAMENTARIUM – GROUP1

Fig: 1b MINI IMPLANT- INTRA ORAL VIEW

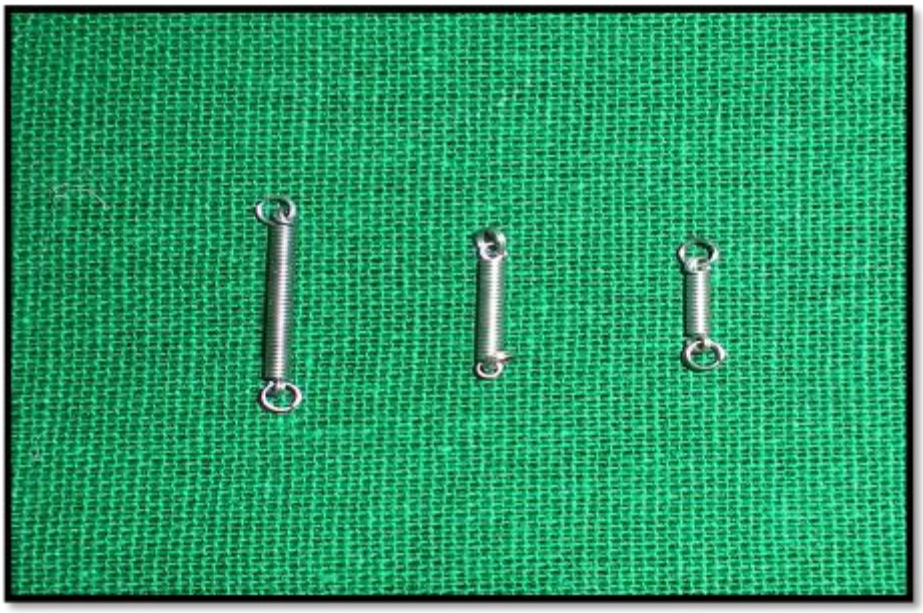


Fig: 2a NITI COIL SPRINGS

Fig: 2b DONTRIX GUAGE

Fig: 3a 'J' HOOKS INTRA ORAL VIEW

Fig: 3b 'J' HOOKS EXTRA ORAL VIEW

Fig: 4a UTILITY ARCH – INTRA ORAL VIEW

Fig: 4b UTILITY ARCH – INTRA ORAL LATERAL VIEW

Fig: 5 CEPHALOSTAT

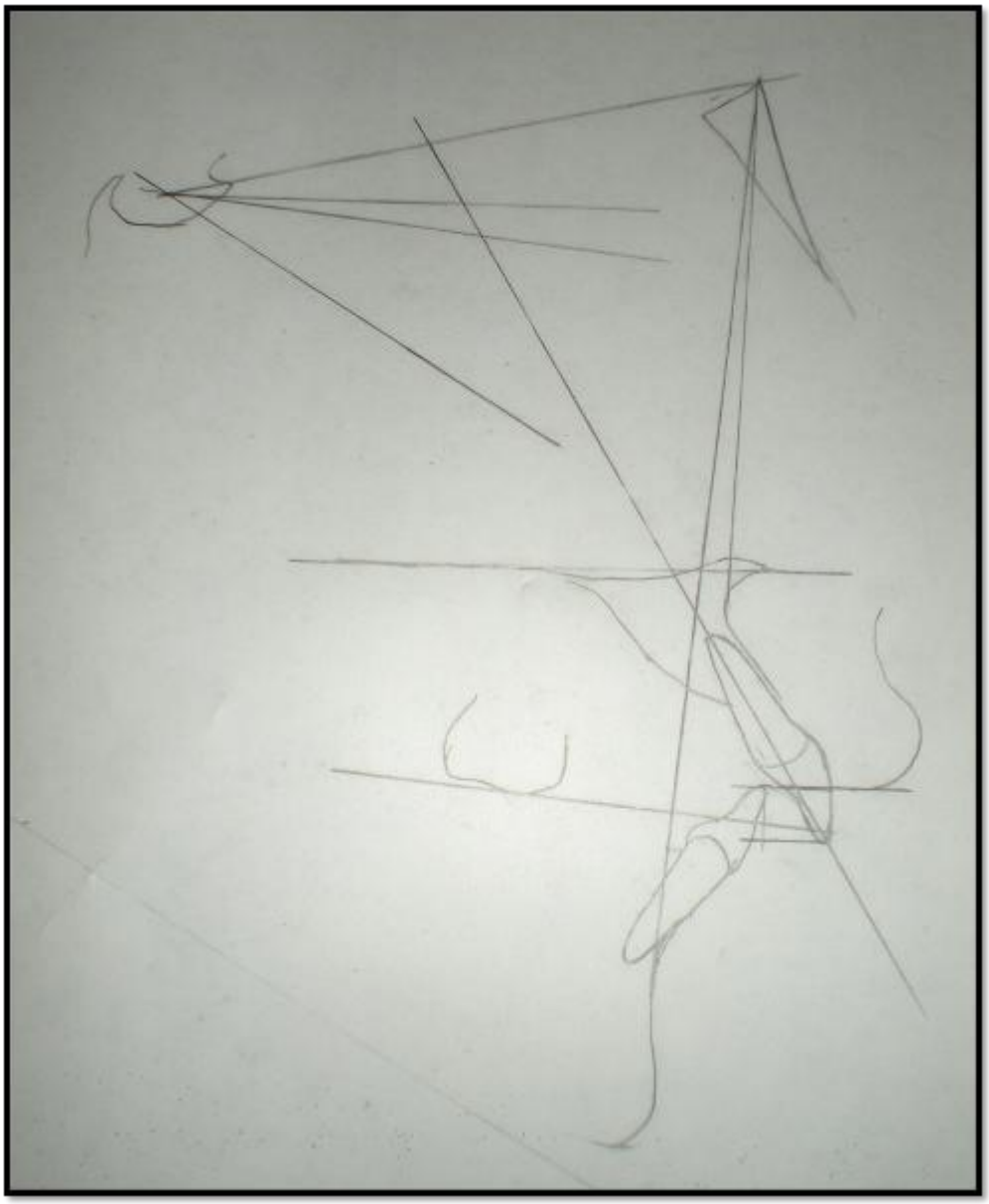


Fig: 6 CEPHALOMETRIC TRACING

RESULTS

The pre treatment and post treatment cephalograms were traced and the values were recorded. Arithmetic mean and standard deviation were calculated for all the pre and post treatment cephalometric parameters in the three groups. The arithmetic mean and standard deviation of the three groups are given below in tables 1, 2 and 3.

TABLE 1- GROUP 1(MINI IMPLANT)

CEPHALOMETRIC PARAMETERS	MEAN ± S.D
Over jet - Pre Treatment	8.58 ±1.20
Over jet - Post Treatment	6.92±.66
Over bite - Pre Treatment	6.25±1.08
Over bite - Post Treatment	3.92±.92
PP U1 - Pre Treatment	31.33±2.58
PP U1 - Post Treatment	29.25±2.52
PP U6 - Pre Treatment	27.17±2.80
PP U6 - Post Treatment	27.00±3.02
UL U1 - Pre Treatment	7.33±3.09
UL U1 - Post Treatment	5.42±2.76

TABLE 2- GROUP 2('J' HOOK HEADGEAR)

CEPHALOMETRIC PARAMETERS	MEAN±S.D
Over jet - Pre Treatment	8.00±2.26
Over jet - Post Treatment	7.20±2.17
Over bite - Pre Treatment	6.20±.84
Over bite - Post Treatment	5.40±.55
PP U1 - Pre Treatment	29.80±2.14
PP U1 - Post Treatment	29.70±2.28
PP U6 - Pre Treatment	24.90±1.47
PP U6 - Post Treatment	25.10±1.43
UL U1 - Pre Treatment	8.90±1.29
UL U1 - Post Treatment	8.10±.74

TABLE 3 - GROUP 3(UTILITY ARCH GROUP)

CEPHALOMETRIC PARAMETERS	MEAN±S.D
Over jet - Pre Treatment	7.75±2.14
Over jet - Post Treatment	7.33±1.51
Over bite - Pre Treatment	7.08±1.96
Over bite - Post Treatment	5.08±2.01
PP U1 - Pre Treatment	30.25±2.54
PP U1 - Post Treatment	28.92±2.87
PP U6 - Pre Treatment	26.33±2.23
PP U6 - Post Treatment	27.08±2.13
UL U1 - Pre Treatment	6.08±2.06
UL U1 - Post Treatment	4.67±1.60

The cephalometric parameters measured were statistically analyzed.

Student's't' test was used to assess significance of difference in the pre and post treatment changes in the individual groups.

Anova was done to assess the significance of pre and post treatment values among the groups and to assess the significance of difference in the pre and post treatment values among the groups. P value <.05 was considered significant. All the analysis were carried out with a statistical analysis software (stat view,SPSS).

Tukey HSD was done for multiple comparisons between the groups.

Student's't' test

The **student's't'** test was used to assess the significance of difference in the pre and post treatment values within the groups.

GROUP 1

In group1 (mini implant group) significant reduction in over bite ($p<0.05$), PP-U1 ($p< 0.05$) and UL-U1 ($p<0.05$) were noted, and no significant change in PP-U6 ($P>0.05$) was noted.

The **student's't'** test values for group 1 are given in table 4

TABLE 4 -STUDENT 't" TEST FOR GROUP 1

		Mean ± Std. Deviation	P value
Pair 1	Over jet - Pre Treatment	8.583±1.2007	.011*
	Over jet - Post Treatment	6.917±.6646	
Pair 2	Over bite - Pre Treatment	6.2500±1.08397	.000**
	Over bite - Post Treatment	3.9167±.91742	
Pair 3	PP U1 - Pre Treatment	31.3333±2.58199	.000**
	PP U1 - Post Treatment	29.2500±2.52488	
Pair 4	PP U6 - Pre Treatment	27.1667±2.80476	.363
	PP U6 - Post Treatment	27.0000±3.01662	
Pair 5	UL U1 - Pre Treatment	7.3333±3.09300	.000**
	UL U1 - Post Treatment	5.4167±2.76436	

Note: * denotes- p <.05, ** denotes – p<.001.

GROUP- 2

In group 2 (J-Hook Headgear group), significant reduction in over bite (p<.05), over jet (p<.05) were noted and no significant changes in PP-U1 (p>.05), PP-U6 (p>.05) and UL-U1 (p>.05) were noted.

The **student's't' test** values for group 2 are given in table 5

TABLE 5- GROUP 2- STUDENT'S't' TEST

		Mean±Std. Deviation	**P value**
Pair 1	Over jet - Pre Treatment	8.000±2.2638	.035*
	Over jet - Post Treatment	7.200±2.1679	
Pair 2	Over bite - Pre Treatment	6.2000±.83666	.016*
	Over bite - Post Treatment	5.4000±.54772	
Pair 3	PP U1 - Pre Treatment	29.8000±2.13892	.374
	PP U1 - Post Treatment	29.7000±2.28035	
Pair 4	PP U6 - Pre Treatment	24.9000±1.47479	.178
	PP U6 - Post Treatment	25.1000±1.43178	
Pair 5	UL U1 - Pre Treatment	8.9000±1.29422	.160
	UL U1 - Post Treatment	8.1000±.74162	

Note: * denotes- p <.05, ** denotes – p<.001.

GROUP - 3

In group 3 (utility arch group), significant reduction in overbite (p<.05), PP-U1 (p<.05) and UL-U1 (p<.05) were noted. Also significant increase in PP-U6 (P<.05) was noted. The **student's 't'test** for group 3 is given in table 6.

TABLE 6 - GROUP 3 STUDENT't' TEST

		Mean **Std. Deviation**	**P** **value**
Pair 1	Over jet - Pre Treatment	7.750±2.1389	.317
	Over jet - Post Treatment	7.333±1.5055	
Pair 2	Over bite - Pre Treatment	7.0833±1.96002	.016*
	Over bite - Post Treatment	5.0833±2.01039	
Pair 3	PP U1 - Pre Treatment	30.2500±2.54460	.003*
	PP U1 - Post Treatment	28.9167±2.87083	
Pair 4	PP U6 - Pre Treatment	26.3333±2.22860	.007*
	PP U6 - Post Treatment	27.0833±2.13112	
Pair 5	UL U1 - Pre Treatment	6.0833±2.05953	.003*
	UL U1 –Post treatment	4.6667±1.60208	

Note: * denotes- p <.05, ** denotes – p<.001.

ANOVA

ANOVA was used to assess the significance of pre and post treatment values among the groups. No significance was found in all the pre and post treatment cephalometric parameters among the three groups. Table 7 gives results of ANOVA to assess the significance of pre and post treatment values among the three groups

TABLE 7- ANOVA

		F	Sig.
Over jet - Pre Treatment	Between Groups	.302	.744
	Within Groups		
	Total		
Over jet - Post Treatment	Between Groups	.117	.890
	Within Groups		
	Total		
Over bite - Pre Treatment	Between Groups	.716	.506
	Within Groups		
	Total		
Over bite - Post Treatment	Between Groups	1.897	.187
	Within Groups		
	Total		
PP U1 - Pre Treatment	Between Groups	.583	.571
	Within Groups		
	Total		
PP U1 - Post Treatment	Between Groups	.125	.884
	Within Groups		
	Total		
PP U6 - Pre Treatment	Between Groups	1.361	.288
	Within Groups		
	Total		
PP U6 - Post Treatment	Between Groups	1.221	.325
	Within Groups		
	Total		
UL U1 - Pre Treatment	Between Groups	2.000	.172
	Within Groups		
	Total		
UL U1 - Post Treatment	Between Groups	4.562	.30
	Within Groups		
	Total		

Note: * denotes- p <.05, ** denotes – p<.001.

ANOVA was also used to assess the significance of difference in the pre and post treatment values among the three groups. The results of ANOVA are,

Statistically significant reductions in over bite, PP-U1 ($p<.05$), PP-UL ($P<.05$) were noted among the three groups. Statistically significant increase in PP-U6 ($p<.05$) was noted among the three groups.

Greater reductions in overbite, PP-U1and UL-U1 were noted in group1 followed by group 3 and least in group 2. Greater increase in PP-U6 was noted in group3 followed by group 2 and least in group1.

Table 8 gives the results of ANOVA used for assessing the significance of difference in pre and post treatment values among the three groups.

TABLE 8 –ANOVA

		Mean	Std. Deviation	P Value
JET_DIF	Group I	1.6667	1.03280	.074
	Group II	.8000	.57009	
	Group III	.4167	.91742	
	Total	.9706	.99169	
BITE_DIF	Group I	2.3333	.51640	.026*
	Group II	.8000	.44721	
	Group III	2.0000	1.26491	
	Total	1.7647	1.03256	
PPU1_DIF	Group I	2.0833	.20412	.000**
	Group II	.1000	.22361	
	Group III	1.3333	.60553	
	Total	1.2353	.90342	
PU6_DIF	Group I	.0000	.00000	.002*
	Group II	.2000	.27386	
	Group III	.7500	.41833	
	Total	.3235	.43088	
ULU1_DIF	Group I	1.9167	.49160	.001*
	Group II	.3000	.44721	
	Group III	1.4167	.66458	
	Total	1.2647	.84996	

Note: * denotes- p <.05, ** denotes – p<.001.

Tukey HSD

Tukey test was used to do multiple comparisons among the three groups

Over bite reduction

Over bite reduction was statistically significant between group1 and 2 ($p<.05$) but not significant between group 1 and 3($p>.05$) and between group 3 and 2($p>.05$).

PP-U1 reduction

PP-U1 measures true intrusion of the maxillary incisors, amount of reduction of PP-U1between pre and post treatment denotes the amount of true intrusion taken place. Statistically Significant reduction in PP-U1 between group1 and group2 ($p>.05$), between group1 and 3($p>.05$), and between group 3and 2($p>.05$), were noted with the highest reduction in PPU1 seen in group1 followed by group3 and least in group2.

PP-U6 increase

PP-U6 measures the extrusion of molar teeth

No statistically significant increase in PP-U6 between group1 and 2($p>.05$) statistically significant difference between group 3 and group1 ($p<.05$) and between group3 and group 2($p<.05$) was noted.

UL-U1 reduction

UL –U1 denotes the incisal show at rest.

Statistically significant reduction of UL-U1 was noted between group1 and 2($p<.05$) and between group 3 and 2($p<.05$).

No significant reduction of UL-U1 was noted between group1 and 3($p>.05$). Highest reduction in UL-U1 was seen in group1 followed by group3 and least in group2. Table 9 gives the results of **tukey** test done for multiple comparisons among the groups.

TABLE 9- TUKEY-MULTIPLE COMPARISONS

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Sig.
JET_DIF	Group I	Group II	.8667	.268
		Group III	1.2500	.067
	Group II	Group I	-.8667	.268
		Group III	.3833	.756
	Group III	Group I	-1.2500	.067
		Group II	-.3833	.756
BITE_DIF	Group I	Group II	1.5333(*)	.025*
		Group III	.3333	.779
	Group II	Group I	-1.5333(*)	.025*
		Group III	-1.2000	.084
	Group III	Group I	-.3333	.779
		Group II	1.2000	.084
PPU1_DIF	Group I	Group II	1.9833(*)	.000**
		Group III	.7500(*)	.015*
	Group II	Group I	-1.9833(*)	.000**
		Group III	-1.2333(*)	.000**
	Group III	Group I	-.7500(*)	.015*
		Group II	1.2333(*)	.000**
PPU6_DIF	Group I	Group II	-.2000	.506
		Group III	-.7500(*)	.001**
	Group II	Group I	.2000	.506
		Group III	-.5500(*)	.019*
	Group III	Group I	.7500(*)	.001**
		Group II	.5500(*)	.019*
ULU1_DIF	Group I	Group II	1.6167(*)	.001**
		Group III	.5000	.287
	Group II	Group I	-1.6167(*)	.001**
		Group III	-1.1167(*)	.012*
	Group III	Group I	-.5000	.287
		Group II	1.1167(*)	.012*

Note: * denotes- p <.05, ** denotes – p<.001.

DISCUSSION

Deep bite is one of the most common types of malocclusions and also it is one of the most difficult one to treat. Deep bite is associated with many complications and hence immediate attention is needed. **Charles Burstone**[9] stated that 'every patient with a deep bite requires a comprehensive treatment plan which establishes how the deep bite should be corrected either by i) extrusion of posterior teeth ii) inhibition of eruption of anterior teeth iii) genuine intrusion of anterior teeth. This decision is based in part on where the clinician desires to place the occlusal plane, the amount of mandibular growth anticipated and the vertical dimension desired at the end of the treatment. Extrusion of posterior teeth commonly is used to correct deep bite especially in growing patients, but it cannot be used in vertical growers and in adults'.

'Absolute intrusion of incisors to correct deep over bite is indicated in patients with excessive maxillary show at rest and a deep mandibular curve of Spee associated with a long lower facial height' as stated by **Bhavna**[6] et al. They

also said that deep overbite correction by intrusion of anterior teeth affords a number of advantages including simplifying control of vertical dimension and allowing forward rotation of mandible to aid in class 2 correction. It also reduces i) torquing requirements, ii) need for class 2 elastics and iii) unfavorable tipping of the Occlusal plane.

In the present study intrusion of maxillary incisors was attempted with different appliances and comparisons were done. All the subjects were adults with a deep overbite associated with excessive maxillary incisor show at rest. The three appliances used for intruding the maxillary incisors were i) mini implants ii) j-hook headgear iii) utility arch.

The use of a high pull headgear with 'J' hooks for maxillary canine retraction was first described by **Farrant**[20] et al. **Deguchi**[18] et al used 'j' hook headgear for intrusion and retraction of maxillary incisors and attained an average of 1.1mm of intrusion of the maxillary incisors.

Ricketts[49] introduced the utility arch; he refined it and later incorporated it in Bio Progressive therapy. The utility arch is an integral part of interceptive as well as comprehensive orthodontic treatment, it is efficient in intruding upper and lower incisors and also in protruding upper and lower anterior teeth. **Otto**[41] et al reported a mean intrusion of 2.5mm in adults and 2mm in children with the lower utility arch.

Mini screws as temporary anchorage devices have become very popular and are widely used for a variety of orthodontic tooth movements. The first clinical report of using temporary devices for intrusion of the maxillary incisors was published by **Creekmore** and **Eklund**[14] in 1983. They inserted a vitallium screw in the anterior nasal spine to intrude the maxillary incisors. After 10 days of screw placement they loaded it with an elastic band and achieved about 6mm of intrusion of the incisors in a year's time. **Kim**[30] et al and **Ohnishi**[24] et al reported intrusion of upper incisors with a mini implant placed in between the two maxillary central incisors. **Deguchi**[18] et al (2008) placed mini implants between maxillary central and lateral

incisors and attained an average of 3.6mm of intrusion of the maxillary incisors in a 6 months' time period. They used a ligature wire from the mini implants to apply force on to the upper incisal segment and maintained a force of 100 grams in 'j' hook headgear group and about 80 to 120 grams in the implant group. In the present study 2 mini implants were inserted in between the maxillary central and lateral incisors on both the sides in the mini implant group and force was delivered with Niti closed coil springs. The amount of force was maintained at 1.5 ounces per side in implant and the utility arch group and 2 ounces per side in 'j' hook headgear group. The study duration was 120 days.

In the present study statistically significant amount of over bite reduction was achieved in all the three groups. The mean pre treatment over bite in all the three groups was 6.25mm, 6.2mm and 7.08mm respectively. The greatest amount of overbite reduction was achieved in the implant group (mean - 2.33mm) followed by utility arch group (mean - 2mm) and the least in 'j' hook headgear group (mean- .8mm). The over bite reduction can be either due to true intrusion of anterior teeth or by extrusion of the

posterior teeth. True intrusion of incisors was measured cephalometrically by the distance from palatal plane to the incisal edge of the upper incisor (PP-U1) and extrusion of the posterior teeth was measured cephalometrically by the distance from the palatal plane to the mesio buccal cusp of the upper molar (PP-U6) as stated by **Deguchi**[18](2008) et al.

Statistically significant amount of true intrusion (PP-U1) of incisors was achieved in mini implant and the utility arch group. The mean average true intrusion in the implant group achieved was 2.1mm with a standard deviation of 0.20mm and in one subject highest intrusion of 3mm was achieved. The mean average true intrusion in utility arch group was 1.33mm with a standard deviation of 0.6mm.

Statistically significant amount of extrusion of molars was achieved only in the utility arch group. The mean average upper molar extrusion in the utility arch was 0.75mm with a standard deviation of 0.41mm. Hence upper molar extrusion has significantly contributed to overbite reduction in utility arch group. Overbite reduction by molar extrusion is not indicated in vertical growers, hence mini

implant assisted intrusion is the preferred choice to correct deep overbite in these patients.

The maxillary incisal show was measured on the lateral cephalogram by the distance from the upper lip to the incisal edge of the maxillary incisor (UL-U1) both before and after the treatment as stated by **Deguchi[18] et al (**2008). The mean pre treatment values of (UL-U1) in all the three groups were 7.33mm, 8.9mm and 6.08mm respectively. Maxillary incisal show at rest was reduced in all the three groups. But statistically significant amount of reduction was achieved only in the mini implant and the utility arch group. The highest difference in the UL-U1values was noted in the implant group (mean-1.91mm), this was followed by the utility arch (mean- 1.41mm) and least in 'j' hook headgear group.

Hence of all the three methods for intruding the maxillary incisors, the mini implant assisted intrusion of maxillary incisors showed the most prominent results, attaining true intrusion without extruding the molars, and with no dependence on patient co operation. The 'j'hook

headgear is highly dependent on patient co operation and this could be the primary reason for its failure. Utility arch is also promising for correction of deep overbite but it combines incisor intrusion along with molar extrusion for achieving the results, which may not be indicated in vertical growers.

SUMMARY AND CONCLUSION

For bite opening both mini implants and utility arch are found to be effective.

The utility arch had resulted in extrusion of molars which prevents its use in high angle cases with deep bite and excessive incisal show.

Deep bite correction with mini implants resulted in effective bite opening through true intrusion of incisors with minimal or no changes in molars and also patient compliance was not required. Hence mini implants are an ideal choice for bite opening in high angle deep bite cases with excessive incisal show.

BIBLIOGRAPHY

1. **Adriano Crismani .G, Michael Bertl H.** Miniscrews in orthodontic treatment: review and analysis of published clinical trials. Am J Orthod Dentofacial Orthop 2010; 137:108-13.
2. **Al-Buraiki H, Sadowsky C, Schneider B.** The effectiveness and long-term Stability of overbite correction with incisor intrusion mechanics. Am JOrthod Dentofacial Orthop. 2005 Jan; 127(1):47-55.
3. **Amr Ragab El-Baeily, Amr Mohamed Abou-El-Aziz.** Loss of anchorage of miniscrews a 3-dimensional assessment. Am J Orthod Dentofacial Orthop 2009;136:700-7.
4. **Bae, S.M.; Park, H.S.; Kyung, H.M.; Kwon, O.W.; and Sung, J.H.:** Clinical application of Micro-Implant Anchorage, J. Clin.Orthod. 36:298-302, 2002.
5. **Benedict Wilmes, Yu-Yu Su, Dieter Drescher (2008)** Insertion Angle Impact on Primary Stability of Orthodontic Mini-Implants. The Angle Orthodontist: November 2008, Vol. 78, No. 6, pp. 1065-1070.

6. **Bhavna Shroff**. Segmented approach to simultaneous intrusion and space closure: Biomechanics of the three piece base arch appliance. Am J Orthod Dentofacial Orthop 1995;107:136-43.
7. **Burstone CJ.** Rationale of the segmented arch. Am J Orthod.1962;48:805–822.
8. **Burstone CJ.** The mechanics of the segmented arch techniques.*Angle Orthod*. 1966; 36:99–120.
9. **Burstone CJ.** Deep overbite correction by intrusion. Am J Orthod. 1977; 72:1–22.
10. **Cheol – hyun Moon.** Relationship between vertical skeletal pattern and success rate of orthodontic mini implants. Am J Orthop Dentofacial Orthop2010;138:51-7.
11. **Cope JB**. Temporary anchorage devices in orthodontics:paradigm shift. Seminar Orthod 2005;11:3-9
12. **Costa, A.; Raffaini, M.; and Melsen, B.:** Miniscrews as orthodontic anchorage: A preliminary report, Int. J. Adult Orthod.Orthog. Surg. 13:201-209, 1998.
13. **Costopoulos G, Nanda R.** An evaluation of root resorption incident to

14. Orthodontic intrusion. Am J Orthod Dentofacial Orthop. 1996 May;109(5):543-14.Creekmore, T.D. and Eklund, M.K.: The possibility of skeletal anchorage, J. Clin. Orthod. 17:266-269, 1983
15. **Dake M L.** Sinclair, comparison of Ricketts and Tweed type arch levelling technique. Am J Orthod Dentofacial Orthop 1989 jan;95(1):72-8
16. **Davidovitch M, Rebellato J.** Two-couple orthodontic appliance systems utility arches: a two-couple intrusion arch. Semin Orthod.1995 Mar;1(1 25-30
17. **Dellinger.** Histological and cephalometric investigation of premolar intrusion in macaca speciosa monkey AJO 53;370-385,1967
18. **Deguchi; Murakami.** Comparison of intrusion effects on the maxillary incisors between implant anchorage and J-hook headgear. Am J Orthop Dentofacial Orthop 2008; 133:654-60.
19. **Eric Liou J.W**. apical root resorption in orthodontic patients with enmasse maxillary retraction and intrusion with mini screws. Am J Orthop Dentofacial Orthop 2010;137:207-12.

20. **Farrant G.** Canine retraction with J hooks headgear. Am J Orthop Dentofacial Orthop 1980 nov:78 (5);538-47.
21. **Gainsforth Higley** Sculpture in orthodontics J Am Dental Asso-1946 may 33;574-81
22. **Glaucio Serra** Sequential bone healing of immediately loaded mini implants :histomorphometric and fluorescence analysis Am J Orthod Dentofacial Orthop 2010;137:80-90
23. **Gray J B**. studies on efficacy of implants as orthodontic anchorage- Am J Orthod Dentofacial Orthop april 1983 (4):311-17
24. **Hidetake Ohnishi, Takakazu Yagi, Yoshitaka Yasuda, Kenji Takada (2005)**. A Mini-Implant for Orthodontic Anchorage in a Deep Overbite Case. The Angle Orthodontist: May 2005, Vol. 75, No. 3, pp. 444-452.
25. **Horn AJ,** Thiers-Jegou Class II deep bite faces: one-phase or two-phase treatment? World J Orthod. 2005 Summer;6(2):171-8.

26. **Hyo-Sang Park,** Factors affecting the clinical success of screw implants used as orthodontic anchorage Am J Orthod Dentofacial Orthop 2006;130:18-25
27. **Janzen EK.** A balanced smile –a most important treatment objective. Am J Orthod 1977;72:359-72.
28. **Kanomi R.** Mini-implant for orthodontic anchorage. J Clin Orthod 1997;31:763-7..
29. **Kim SH, Kang SM, Choi YS, Kook YA, Chung KR, Huang JC.** Cone-beam computed tomography evaluation of mini-implants after placement: Is root proximity a major risk factor for failure? Am J Orthod Dentofacial Orthop.
30. **Kim TW, Kim H, Lee SJ**. Correction of deep overbite and gummy smile by using a mini-implant with a segmented wire in a growing Class II Division 2 patient. Am J Orthod Dentofacial Orthop.2006 Nov;130(5):676-85.
31. **Kuroda S, Sugawara Y, Deguchi T, Kyung HM, Takano-Yamamoto T.** Clinical use of miniscrew implants as orthodontic anchorage: success rates and postoperative discomfort. Am J Orthod Dentofacial Orthop 2007;131:9-15.

32. **Kuroda S, Katayama A, Takano-Yamamoto T.** Severe anterior open-bite case treated using titanium screw anchorage Angle Orthod 2004;74:558-67.
33. **Magill J.M.** Changes in the anterior overbite relationship following orthodontic treatment in extraction cases, A.J.O 46:755-788, 1960.
34. **Marissa.** A Radiographic Evaluation of the Availability of Bone for Placement of Miniscrews Angle Orthod 2004; 74:832–837.
35. **Melsen B, Costa A.** Immediate loading of implants used for orthodontic anchorage. Clin Orthod Res 2000; 3:23-8.
36. **Mershon J.V.** int. j of ortho and oral surgery. 33:581-589, 1937
37. **Michael B. Packard, Paul Dechow**. Effects of miniscrew orientation on implant stability and resistance to failure. Am J Orthod Dentofacial Orthop 2010; 137:91-9.
38. **Miyawaki S, Koyama I, Inoue M, Mishima K, Sugahara T, Takano-Yamamoto T**. Factors associated with the stability of titanium screws placed

in the posterior region for orthodontic anchorage. Am J Orthod Dentofacial Orthop 2003; 124:373-8.

39. **Naam-Ki Lee, Seung-Hak Baek.** Effects of the diameter and shape of orthodontic mini-implants on the micro damage to the cortical bone. Am J Orthop Dentofacial Orthop 2010; 138:8-9.
40. **Nanda R 1997** Correction of deep overbite in adults. Dental Clinics of North America 41: 67 – 87
41. **Otto.** A comparative analysis of intrusion of incisor achieved in adults and children according to facial type. . Am J Orthop Dentofacial Orthop 1980 april 77 (9): 437-46
42. **Park, H.S.; Bae, S.M.; Kyung, H.M.; and Sung, J.H.:** Micro-Implant Anchorage for treatment of skeletal Class I bialveolar protrusion, J. Clin. Orthod. 35:417-422, 2001.
43. **Park, H.S.; Bae, S.M.; Kyung, H.M.; and Sung, J.H.:** Micro-Implant Anchorage for treatment of skeletal Class I bialveolar protrusion, J. Clin. Orthod. 35:417-422, 2001.
44. **Poggio, P.M.; Incorvati, C.; Velo, S.; and Carano, A: "Safezones":** A guide for miniscrew positioning in

the maxillary and mandibular arch, Angle Orthod. 76:191-197, 2006.

45. **Polat-Ozsoy O, Arman-Ozcirpici A, Veziroglu F.** Miniscrews for upper incisor intrusion. Eur J Orthod. 2009 Aug;31(4):412-6.
46. **Proffit WR, Fields HW.** Contemporary Orthodontics. 3rd ed. St Louis, Mo: Mosby; 2000:326–361
47. **Rahul Renjen, Anthony L. Maganzini.** Root and pulp response after intentional injury from miniscrew placement. Am J Orthop Dentofacial Orthop 2009; 136:708-14
48. **Reitan K.** Initial tissue behaviour during apical root resorption, Angle Ortho 44:68-82, 1974.
49. **Ricketts RM, Bench RW, Gugino CF, Hilgers JJ, Schulhof RJ.** Bioprogressive therapy. Denver: Rocky Mountain Orthodontics; 1979.
50. **Robert E. Moyers;** Handbook of orthodontics 4th edition, year book medical publishers,1988;400-02.
51. **Sebastian Baumgaertel.** Pre drilling of the implant site: is it necessary for orthodontic mini implants? Am J Orthod Dentofacial Orthop 2010;137:825-9.

52. **Shin-Jae Lee, Sug-Joon Ahn.** Survival analysis of orthodontic mini-implants. Am J Orthod Dentofacial Orthop 2010;137:194-9.
53. **Sifakakis.** Forces and moments on posterior teeth generated by incisor intrusion biomechanics. . Orthod Craniofac Res. 2009 Nov;12(4): 305-11
54. **Sonnesen, Svensson.** Temporomandibular disorders and psychological status in adult patients with a deep bite. Eur JOrthod. 2008 Dec;30(6):621-9.
55. **Southard TE, Buckley MJ, Spivey JD, Krizan KE, Casko JS.** Intrusion anchorage potential of teeth versus rigid endosseous implants:a clinical and radiographic evaluation. Am J Orthod DentofacialOrthop. 1995;107:115–120.
56. **Stenvik Mjor IA.** Pulp and dentin reaction to experimental tooth intrusion AJO- 57:370-385.
57. **Upadhyay M.** Mini-implants for en masse intrusion of maxillary anterior teeth in a severe Class II division 2 malocclusion. J Orthod. 2008 Jun;35(2):79-89
58. **Van Steenbergen.** The Influence of Force Magnitude on Intrusion of the Maxillary Segment. Angle Orthod 2005;75:723–729.

59. **Van Steenbergen E, Burstone CJ, Prahl-Andersen B, Aartman IH.** The relation between the point of force application and flaring of the anterior segment. Angle Orthod. 2005;75:730–735.

60. **Willes G.** A Finite element model of apical force distribution from orthodontic tooth movement AO-2001;71:127-131.

61. **Wilmes B Rademacher C, Olthoff G.** Parameters affecting primary stability of orthodontic mini-implants. J Orofac Orthop 2006;67:162-74.

ANNEXURES

INFORMED CONSENT FORM

STUDY TITLE:

COMPARISON OF THE INTRUSION EFFECTS ON THE MAXILLARY INCISORS AMONG IMPLANT ANCHORAGE, J HOOK HEADGEAR AND UTILITY ARCH.

Name: O.P.No:

Address: Code No:

Age / Sex:

Tel. no:

I,_____, exercising my free power of choice, hereby give my consent to be included as a participant in the study.

I agree to the following:

- I have been informed to my satisfaction about the purpose of the study and study procedures.
- I understand that the study involves an orthodontic procedure for tooth movement.
- I agree to cooperate fully and to inform my doctor immediately if I suffer any unusual symptom.
- I agree that the orthodontic procedure may be used for the research purpose.
- I agree to report to the doctor for a regular follow up as and when required for the research.
- I have informed the doctor about all medications that I am currently taking and other systemic illnesses that I have.
- I hereby give permission to use my medical records for research purpose. I am told that the investigating doctor and institution will keep my identity confidential.

Name of the patient Name of the investigator

Signature / Thumb impression Signature

Date:

தகவல் அறிக்கை

ஆய்வுத் தலைப்பு:

"மேல் தாடை பற்கள் சீர் செய்ய சிறு திருகாணி, ஜே கொக்கி, ஹெட் கியர், யுடிலிட்டி ஆர்ச் ஆகிய மூன்று முறைகளையும் ஒப்பிடுதல்"

ஆய்வு முறை:

செய்முறை விளக்கம்:

இந்த ஆய்வு 3 குழுக்களில் செய்யப்படும்.

குழு 1:

மேல்தாடையில் மரப்பு ஊசி போடப்பட்டு, இரண்டு சிறு திருகாணிகள், மேல்தாடை எலும்பில் பல் எண்.11, 21-க்கும், 21, 22-க்கும் நடுவில் பொருத்தப்படும். இந்த பற்களை மேல்நோக்கி இழுக்கும் விசை இந்த சிறு திருகாணிகளில் இருந்து ஒரு ஸ்பிரிங் (சுருள் வீல்) மூலம் கொடுக்கப்படுகிறது. இக்குழு உறுப்பினர்கள் மாதத்திற்கு ஒருமுறை பரிசோதிக்கப்படுவார்கள்.

குழு 2:

இரண்டு ஜே கொக்கிகள் பல் எண்.11, 21-க்கும், 21, 22-க்கும் நடுவில் இருந்து இருபுறமும் பொருத்தப்படுகிறது. தலைப்பட்டையிலிருந்து ஒரு நெகிழும் பட்டை (எலாஸ்டிக்) வழியாக மேல்நோக்கி இழுக்கும் விசை அளிக்கப்படுகிறது. இந்த தலைப்பட்டையை இரவில் மட்டும் அணிய வேண்டும். இந்தக் குழு உறுப்பினர்கள் மாதத்திற்கு ஒருமுறை பரிசோதிக்கப்படுவார்கள்.

குழு 3:

இந்தக் குழுவில், பற்களை மேல்நோக்கி இழுக்கும் விசை யுடிலிட்டி ஆர்ச் வழியாக அளிக்கப்படும். இந்தக் குழுவைச் சேர்ந்தவர்கள் மாதம் ஒருமுறை பரிசோதிக்கப்படுவர்.

இந்த ஆய்வு முழுவதும் 120 நாட்களுக்குள் நடத்தப்படும். பங்கேற்பாளர்களின் ஆய்வுக்கு முந்தைய மற்றும் பிந்தைய நுண்கதிர் படமும், புகைப்படமும் எடுக்கப்பட்டு ஒப்பிடப்படுகிறது.

Information sheet

Title of the study - Comparison of intrusion effects on the maxillary incisors among J-hook headgear, utility arch and mini implants.

Procedure

The study will be done in three groups

Group 1

In this group, two mini implants will be placed on both sides between the teeth no.11, 12and 21, 22 under local anaesthesia. Force to intrude the teeth will be applied from the implant to the arch wire by a spring. Subjects will be seen once monthly for check up.

Group 2

J-Hooks will be placed on the arch wire between teeth no. 11, 12 and 21, 22 on both sides. Force will be given by an elastic strap connected to a headgear. All subjects will be told to wear the headgear at night, they will be asked to come monthly once for check up.

Group 3

Utility arch will be used for intruding the upper front teeth. Subjects will be called monthly once for check up.

The total duration of the study will be 120 days. Radiographs, photographs will be taken before and after the treatment to measure the amount of intrusion of the upper front teeth attained in all the groups and compared.

சுய ஒப்புதல் படிவம்

ஆய்வு தலைப்பு:

"மேல் தாடை பற்கள் சீர் செய்ய இம்ப்லேண்ட், ஜே ஹீக் ஹெட் கியர், யுடிலிட்டி ஆர்ச் ஆகிய மூன்று முறைகளையும் ஒப்பிடுதல்".

பெயர்: ஓ.பி. எண்.

முகவரி: வயது / பாலினம்:

தொலைபேசி எண். நாள்:

..... ஆகிய நான் இந்த ஆய்வுக்கு என்னை ஒரு பங்கேற்பாளராக உட்படுத்திக் கொள்ள என் சுய நினைவோடு ஒப்புதல் அளிக்கிறேன்.

கீழ்க்கண்ட நிபந்தனைகளுக்கு நான் ஒப்புதல் அளிக்கிறேன

- இந்த ஆய்வின் நோக்கங்களையும், அதை செயல்படுத்தப்படவிருக்கும் வழிமுறைகளையும் பற்றி மருத்துவர் எனக்கு தெரிவித்துள்ளார்.
- எனக்கு இந்த ஆய்வில் பல் சீரமைப்பு பற்றி புரிந்துள்ளது. எனக்கு ஆய்வு பல் சீரமைப்புக்காக மேற்கொள்ளப்படுகிறது என்பதை அறிவேன்.
- இந்த ஆய்வுக்காக மருத்துவருடன் முழுமையாக ஒத்துழைக்க சம்மதிக்கிறேன். இந்த ஆய்வின்போது எனக்கு ஏதேனும் அசௌகரியங்கள் ஏற்படுமாயின் அதனை மருத்துவருக்கு உடனடியாக தெரிவிக்க சம்மதிக்கிறேன்.
- இந்த ஆய்வு ஆராய்ச்சி நோக்கத்திற்காக பயன்படுத்தக்கூடும் என்பதையும் நான் அறிவேன்.
- இது சம்மந்தமாக தொடர் கண்காணிப்பிற்கு மருத்துவர் அழைக்கும்போது வருவதற்கும் ஒத்துழைக்க நான் சம்மதிக்கிறேன்.
- தற்போது எனக்கு உள்ள உடல்நிலைமை மற்றும் நான் மேற்கொண்டுள்ள சிகிச்சை முறைகள் பற்றியும் மருத்துவரிடம் தெரிவித்துள்ளேன்.
- என்னுடைய மருத்துவ குறிப்புகளை இந்த ஆராய்ச்சிக்காக பயன்படுத்திக் கொள்ள சம்மதிக்கிறேன்.
- இந்த ஆய்வின்போது இது பற்றிய விவரங்கள் அனைத்தும் இரகசியமாக பாதுகாக்கப்படும் என்று இந்த ஆய்வினை மேற்கொள்ளும் மருத்துவர் என்னிடம் கூறியுள்ளார்.

நோயாளியின் பெயர்: மருத்துவ ஆய்வாளர் பெயர்:

கையொப்பம்/கைரேகை கையொப்பம்

CHECK LIST

Patient name: age/sex:

Mechanotherapy:

Intrusion mechanics:

Pretreatment radiographs

1.lateral ceph ☐

2.opg ☐

3.iopa ☐

Pretreatment Photographs

1.extra oral ☐

2.intra oral ☐

Pretreatment Models ☐